REMARKS

In the Office Action, claims 1-2, 6-8, and 12-14 were rejected under 35 U.S.C. § 103 on the basis of Rose (6,248,994). Applicant has carefully reviewed the Rose reference and has amended the claims to more clearly define Applicant's invention in view of Rose and the remaining art of record, including the art submitted by the Information Disclosure Statement enclosed herewith.

Initially, it should be noted that the Rose reference, as well as the remaining references of record and those of the enclosed Information Disclosure Statement, all employ some form of a lens system. Rose, for example, employs a lens 16 for providing Fourier-transformed speckle patterns onto a sensor. Applicant's system, on the other hand, is a lensless system in which, in one embodiment, the lens of a CCD camera was actually removed (see page 8, lines 5-8) to provide a direct imaging of reflected speckle patterns onto the image sensor itself.

In addition, however, to this specific structural difference resulting in a different image processing, Applicant's invention is specifically directed to detection of movement of an object toward and away from the detector as opposed to the angular movement detection of an object as disclosed by Rose. While the Rose reference casually mentions in, for example, the abstract the simultaneous determining of angular displacement and surface translation of an object, a careful reading of Rose shows, for example, in column 11 beginning on line 42 that the translation of the surface originates from the angular displacement of the object. Column 11, lines 45-52, for example states:

> . . . then the translation of the surface **originating from the angular displacement f the object** 10 toward a linear displacement of the distribution of

> speckles detected therein. By determining the **angular displacement and the corresponding surface translation** of the object 10, in both image sensors 18*a* and 18*b*, respectively, based on cross-correlation of their displaced distributions of speckles, the radius of angular displacement is determined by methods known in the art. (emphasis supplied)

Thus, not only does Rose employ a Fourier-transforming lens, it also does not detect movement of an object moved toward and away from the detector using direct detection of a speckle pattern as specifically defined in Applicant's invention as now claimed.

The Examiner in the Office Action at page 3 points to column 14, lines 7-19 of Rose for the proposition that a line sensor directly picks up the granular speck pattern. In reviewing this disclosure, however, it references Figs. 1c and 2, which discuss in column 10, lines 13-16, the placement of the detector is in the Fourier plane 15, which is behind lens 16. Thus, it is clear that the Rose patent does not teach the direct sensing of the speckle pattern without the use of a Fourier-transforming lens.

The claims of the present application have been amended to define a lensless method and lensless apparatus in which a granular speck pattern is directly detected and such pattern is initially used as an index. Subsequently, upon moving the object toward or away from the detector (as defined in the claims as amended), the amount of movement based upon the comparison of granular speck patterns allows the calculation of a numerical value representing the movement. Each of the independent claims 1, 2, 6, 7, 8, and 13 have been amended to clearly define this concept which is absent from the disclosure of Rose or the remaining references. Accordingly, reconsideration of the rejection of claims 1, 2, 6, 8, and 12-14 is respectfully requested.

Claims 3, 9, and 15 were rejected on the combination of Rose and Omura. Although suggesting, as noted in the English translation provided by the Office Action, a light shield of an optical absorption type is provided, the Omura disclosure includes, as seen in Fig. 1, a lens system 2 not employed by Applicant's system. Further, the Omura reference appears to be solely directed to a document identifying device and is not employed in connection with detecting movement of an object toward and away from the detector. Accordingly, even if combined with Rose, the combined teachings would not suggest Applicant's invention as defined by the amended claims presented herein.

Claims 4, 5, 10, 11, and 15-17 were also rejected on the combination of Rose and Omura and further in view of Kashiwagi et al., which discloses a production machine for mounting electrical components onto a substrate. The system employs a lens 32, as seen in Fig. 5, and a light source 37 for providing signals for controlling the rotational position of a line sensor. The Kashiwagi et al. patent, therefore, relates to subject matter totally unrelated to Applicant's invention in which direct detection of movement of an object toward and away from the detector is the purpose and function of the method and apparatus and not the angular positioning of a part on a substrate where the substrate is in a fixed location and the only adjustment necessary is an angular adjustment. It is submitted that Kashiwagi et al., therefore, would not be considered by one skilled in the art in solving Applicant's problem nor does the document identifier reference to Omura suggest themselves or provide any motivation for their combinations suggested only by the Examiner in the Office Action. Accordingly, reconsideration of the combination rejection of

the dependent claims based upon Omura and Kashiwagi is also respectfully requested in view, particularly, of the amendments herein.

By this Amendment, it is submitted that this application is now in condition for allowance, which action is respectfully requested.

Respectfully submitted,

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APPENDIX A
Version With Markings to Show Changes Made

1. (amended) A lensless method for measuring the amount which an object to be measured has moved in a plane and back-and-forth using a granular speck pattern generated by a reflecting laser beam in non-contact fashion comprising steps of:

irradiating an object to be measured with a laser beam;

[~~optically and~~] directly [~~picking up~~] detecting the granular speck pattern generated by the reflecting laser beam by a detector and using the detected speck pattern as an index;

moving the object toward or away from the detector;

calculating the amount of movement [~~on the basis of~~] of the object based upon the movement of [~~the~~] a new granular speck pattern corresponding to the moved position of the object with respect to said index; and

displaying a result of the calculation as a numerical value of the measured amount of movement.

2. (amended) [~~An~~] A lensless apparatus for measuring the amount which an object to be measured has moved in a plane and back and forth using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:

a laser projector to generate a granular speck pattern corresponding to a rough surface of an object to be measured;

a line sensor to directly pick up without a lens said granular speck pattern used as an index;

an A/D converter coupled to said line sensor to convert an analog signal supplied from said line sensor to a digital signal;

a processing unit coupled to the A/D converter to calculate the amount of movement of said object toward and away from said sensor on the basis of movement of the granular speck in said pattern with respect to a change in the pixel interval of said granular speck pattern picked up by said line sensor and represented by said A/D converted signal; and

a display coupled to said processing unit to display the amount of movement calculated by said processing unit.

6. (amended) [~~An~~] A lensless apparatus for measuring the amount which an object to be measured has moved in a plane and back and forth using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:

a laser projector for generating a granular speck pattern corresponding to the surface of an object to be measured;

a line sensor positioned to detect directly without a lens said granular speck pattern as an index; and

an electrical circuit coupled to said line sensor for calculating the amount of movement of said object toward and away from said sensor on the basis of movement of the granular speck in said pattern with respect to a pixel interval of said granular speck pattern picked up by said line sensor and displaying the amount of movement calculated by said processing unit.

7. (amended) A lensless method for measuring the amount which an object to be measured has moved by detecting a granular speck pattern reflected by a laser beam comprising steps of:

irradiating an object to be measured with a laser beam;

directly detecting a granular speck pattern generated by the reflecting laser beam by a detector and using the detected pattern as an index;

moving the object with respect to said detector;

calculating the amount of movement [~~on the basis of~~] of the object based upon movement of the granular speck pattern corresponding to the moved position of the object with respect to said index; and

displaying a result of the calculation as a numerical value of the measured amount of movement.

8. (amended) [~~An~~] A lensless apparatus for measuring the amount which an object to be measured has moved using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:

a laser source for generating a granular speck pattern corresponding to a rough surface of an object to be measured;

a line sensor positioned to detect directly without a lens said granular speck pattern as an index;

a processing unit coupled to said line sensor to calculate the amount of movement of said object on the basis of movement of a granular speck in said granular speck pattern with respect to a pixel interval of said granular speck pattern detected by said line sensor; and

a display coupled to said processing unit to display the amount of movement calculated by said processing unit.

13. (amended) [~~An~~] A lensless apparatus for measuring the amount which an object to be measured has moved in a plane and back and forth using a granular speck pattern generated by a reflecting laser beam, said apparatus comprising:

a collimated light source for generating a granular speck pattern corresponding to the surface of an object to be measured;

a line sensor positioned to detect directly without a lens said granular speck pattern as an index; and

an electrical circuit coupled to said line sensor for calculating the amount of movement of said object on the basis of movement of the granular speck in said pattern with respect to a pixel interval of said granular speck pattern picked up by said line sensor and displaying the amount of movement calculated by said processing unit.